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SCARLET, AN AUTOSOMAL EYE COLOR IDENTICAL WITH SEX-LINKED VERMILION.

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Vermilion, a sex-linked eye color in *Drosophila melanogaster* (*ampelophila*), is duplicated in appearance by a new mutant called scarlet (symbol s_t). The gene for scarlet is located in the third chromosome to the left of dichæte. In spite of this difference of location of the genes for the two eye colors they are quite indistinguishable in appearance and can not be separated from each other when mixed. Here we have a case in *Drosophila* like the well-known case of the two whites in sweet peas.

Upon crossing scarlet and vermilion, wild-type red is produced. Reciprocal crosses between scarlet and vermilion cut-winged flies from stock gave the following results in F_1 . A vermilion cut male mated to a scarlet female produced offspring entirely wild-type in appearance both for eyes and wings. Reciprocally a scarlet male by a vermilion cut female gave wild-type daughters, while the sons showed the sex-linked characteristics of the mother, viz., vermilion eyes and cut wings.

The next generation was not obtained because the writer entered military service before completing it, but the significant fact is demonstrated already that in *Drosophila* as elsewhere, indistinguishable characters may be produced by differently located genes.

ORIGIN OF SCARLET AND PINKOID.

The origin of scarlet was rather remarkable as it first appeared in a strain which already contained eosin, and at the same time was found a new eye color, pinkoid, whose gene is in the second chromosome. In a cross of a bar male to an eosin miniature female of non-disjunctional stock, there appeared in the offspring 38 females which were normal in appearance and did *not* have the heterozygous bar eye. These females were due to reversion

of the bar gene. One of these females, which was heterozygous for eosin and miniature, was crossed to an eosin miniature brother. The offspring showed no bar, but the eosin flies were very variable, some appearing darker than usual and some lighter like eosin. This was probably totally unrelated to the reversion of the bar factor, for the next generation, produced from eosin flies of the above mating, showed unexpected results. A great variety of eye colors were present. Two of these were the two new mutants found March 18, 1918 and the other colors were different combinations with eosin. The scarlet individuals were thought to be vermilion until the gene was found to be not sex-linked. The pinkoid flies had an eye-color very closely resembling that of the mutant race known as pink, but had the further interesting characteristic that the wings were also very greatly affected, resembling typically the wings of the "inflated" stock, which is sex-linked. When the eyes were pinkoid the wings were always abnormal, being either inflated as if by a bubble of air or else being shortened and wrinkled. That both the eye-color and the wing character are the result of the same gene is probable because they appeared at the same time in the same individuals and all efforts to obtain the eye-color separate by outcrossing and back crossing have failed.

Owing to the circumstances surrounding the appearance of these two mutants, nothing can be said concerning the stock from which they arose. When first observed, eosin was also present and altogether a most remarkable array of colors was produced. The homozygous form of either new mutant with eosin is white in appearance. The colors ranged from this multiple white up through cream, lemon, eosin, orange, pinkoid to normal red; according to the combination existing in any one individual.

LOCATION OF NEW GENES.

Pinkoid and scarlet were not sex-linked and were found to be freely segregating from each other. Such segregations indicated that they were in separate autosomes. Accordingly they were each crossed to the double dominant form star dichæte, the genes of which are in the second and third chromosomes respectively. A star dichæte male resulting from these crosses was

then back crossed either to pinkoid or scarlet stock, as the case might be. Males were used thus because there is no crossing over in males in *melanogaster*. Pinkoid was found to be a second chromosome gene as no star fly was pinkoid but all not-star individuals were pinkoid without regard to whether or not they were also dichæte. The pinkoid strain had a very low viability, however, and was hard to keep going, so that it is not a satisfactory character for use in genetic experiments. The strain died out while efforts were being made to place the gene in the second chromosome by its linkage to other second chromosome genes.

By a similar cross, scarlet was found to be in the third chromosome; as a star dichæte male, heterozygous for scarlet, back crossed to a scarlet female produced dichæte flies which were never scarlet, and not-dichæte flies which were always scarlet.

Further tests were made to dichæte and to hairless in the third chromosome by crossing scarlet to each and back crossing the heterozygous hairless or dichæte females to pure scarlet males. The results indicated that scarlet is to the left of dichæte in the chromosome, though more extensive data should be obtained. The counts from three cultures gave 534 non-crossovers and 15 crossovers between dichæte and scarlet, or a percentage of crossing-over of 2.7. Three cultures to test linkage to hairless produced a total of 552 flies of which 140 were in crossover classes, which gives a crossover value of 25.4 per cent. According to unpublished data of Bridges and Gowen the crossover percentage of dichæte and hairless is 18.6. The data here recorded indicate that scarlet is to the left of dichæte, as scarlet gave a crossover value of 25.4 from hairless and scarlet is not far enough from dichæte to be to the right of hairless. However, the relative order of scarlet and dichæte can be definitely settled by more data and by using scarlet with two loci of known position simultaneously.

SUMMARY.

1. Scarlet is a new eye color identical in appearance with vermilion but in the third chromosome.
2. When scarlet is crossed to vermilion, normal red eyes result, except where sons inherit vermilion from their mother.

3. Scarlet gives a crossover percentage of 2.7 with dichæte and 25.4 with hairless.

4. Pinkoid is a new second chromosome mutant that appeared contemporaneously with scarlet, and that affects both the color of the eye and the shape of the wings.

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